EFFECTS OF ENVIRONMENTAL VARIABLES ON SOME PHYSIOLOGICAL RESPONSES OF *MICROTUS MONTANUS* UNDER NATURAL CONDITIONS

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Objectives

Cyclic fluctuations in the population density of microtine rodents have been known since antiquity. However, factors responsible for this phenomenon are not known.

The objectives of this long term study are essentially threefold:

1. characterize those environmental variables that might affect *Microtus montanus* in different seasons of the year;
2. record the growth, maturation and reproductive activity of the voles under natural conditions; and
3. determine the maturational, as well as, the seasonal pelage changes of these rodents.

The data resulting from the execution of the above objectives would be correlated in an attempt to determine the causes underlying the multiannual fluctuations in the population density of these microtine rodents in Grand Teton National Park.

Methods

Microtus montanus were livetrapped and sacrificed as soon as possible after capture. Age estimation for all animals was based on weight, total length, and pelage characteristics. Reproductive organs, the spleen, and the adrenal glands were collected from the animals and preserved in Lillie's buffered neutral formalin for further histological study. Flat skins were prepared from all animals. All tissues are currently being processed at the Department of Biological Sciences, University of New Orleans.

In 1982 field observations in Grand Teton National Park were carried out over two study periods: spring (22-28 May) and summer (13 July - 5 August).

Results

The onset of the spring growing season in 1982 was very late: since the study was begun in 1969 a later spring was recorded only in 1970 and in 1975. All

females were pregnant with their first litter, none were lactating. Judging from the size of the embryos, breeding on a population-wide basis had begun approximately during the second and third week in May. Such late onset of breeding was not at all unexpected considering the extremely late meltoff in 1982 (as in all the previous springs, the onset of the breeding season was very closely correlated with meltoff). Recent cuttings could be found only in isolated patches. The population density had risen above that of 1981.

The spring findings were confirmed during the summer study period. The population density had, indeed, increased dramatically over the 1981 crash levels. This observation was very gratifying as it confirmed a hypothesis I had proposed in 1981, namely, that mild declines are followed by yet another decline in the ensuing year; crashes are followed by an increase in population density in the ensuing year. For example, in 1974, 1977 and 1980 the population density had shown a mild decline (from the levels observed in 1973, 1976 and 1979, respectively). In each of these cases the first mild decline was followed by yet another decline in the ensuing year (1975, 1978 and 1981, respectively). The only two instances where a decline was followed by a rise in density occurred in 1971 and in 1982 (following the crash of 1970 and 1981, respectively).

Despite the late onset of breeding the population density rose rapidly throughout the summer of 1982. Several factors could be responsible for this. First, the vegetative growth of plants was delayed dramatically during the 1982 season (for example, during the first week in July when summer observations were begun, the plants were about three weeks "behind" in their growth stages of other years). The vegetation was luxuriant, providing an abundance of green plant food for the voles throughout the summer. The luxuriance of the vegetation was probably due in part to the very high moisture content of the soil, resulting from the very high water content of the previous winter's snow. Second, the voles showed an exceptionally high reproductive performance in the summer of 1982. The mean litter size was 6.6, the highest mean litter size recorded since the study began in 1969. The smallest litter was five - this ranks among the highest values ever observed for the minimum litter size in the summer study period. The lateness in the availability of vegetatively growing plants may have contributed to the high litter sizes, since substances in plants that have a stimulatory effect on reproduction are present in highest amounts in vegetatively growing plants. Third, predation pressure was relatively low since weasels were not abundant - only one weasel entered the vole traps during the entire summer study period.

Although population density had increased dramatically over the 1981 levels, the voles were distributed in a pattern characteristic of years of low population density. In other words, the animals occurred in small, distinct, widely spaced colonies. As in 1981, the luxuriance of the vegetation made the location of these colonies difficult.

An interesting incidental finding was the discovery of a white spotted pocket gopher (Thomomys). Although Thomomys frequently enter traps set for Microtus, this is the first time since the study was begun that a pocket gopher exhibiting a coat color mutation was observed.

Conclusions

The findings of 1982 confirm a hypothesis I had proposed in 1981: a mild decline in the population density of *Microtus montanus* in Grand Teton National Park is followed by yet another decline in the ensuing year; a crash is followed by an increase in population density in the ensuing year.

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